ChE department

NEWARK COLLEGE OF ENGINEERING

DEPARTMENT FACULTY
New Jersey Institute of Technology
Newark College of Engineering
Newark, New Jersey 07102

CHEMICAL ENGINEERING AND CHEMISTRY have been major educational elements since Newark College of Engineering initiated degree programs in 1919.

Recent changes have brought about a new institutional name, New Jersey Institute of Technology, (under which Newark College of Engineering continues as a cohesive form for engineering education) ; a new multi-million dollar facility; and a continuity of curriculum updating. A seasoned faculty with long experience at the Institute has had exceptionally positive relations with NJIT undergraduate and graduate students, as well as a record of active participation in all important aspects of the institution and of professional life.

In recent years the department graduated an average of 100 chemical engineering students per year—roughly 80 B.S., 18 M.S. and two D.Sc. students per year, a far cry from its first graduating class of three, more than a half century ago.

A particularly distinctive aspect of the educational operation is the affiliation and relationship of the members of the two allied divisions of the department—chemical engineering and chemistry. Cooperative ventures in interdisciplinary research, multidisciplinary graduate and undergraduate curricula, and collaboration on departmental curricula changes are routine practices. From a table of organization viewpoint Chemistry has 17 faculty members and Chemical

Engineering 13; but from a viewpoint of academic realities the two divisions act as one in considerations affecting the department.

As a stable and senior department of the Institute, Chemical Engineering/Chemistry employs an excellent reputation on campus for its approach to teaching, research educational activities, student relations and involvement in active faculty governance.

Within the professional societies there has been a long record of active participation in AIChE, ACS and ASEE, represented by many different forms of local and national organizational involvement.

DEPARTMENT HISTORY

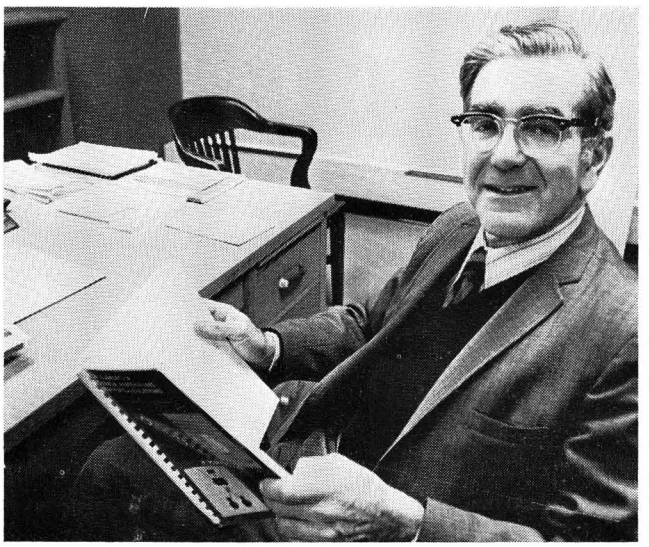
NEW JERSEY INSTITUTE OF TECHNOLOGY (NJIT) started as Newark Technical School in 1881 and has operated under a number of names in its 90-year history. Originally funded by community leaders and later by a joint committment by City and State, the Institute still enjoys an arrangement by which the State contracts with the Board of Trustees for the providing of education. The original purpose of the Institute 90 years ago was to provide a wealth of skilled talent for New Jersey industry; in large respect this purpose still stands since the majority of chemical engineering graduates, as well as those of other engineering disciplines, are absorbed into the tremendous variety of regional industry.

When formal degree programs were organized in the Fall of 1919 chemical engineering became one of the first degree-granting departments, capitalizing on the strength of existing chemistry courses and related offerings. While titled Chemical Engineering, instruction in chemistry continued, establishing the rapport that continues in certain aspects today.

Another interesting feature of NJIT's department is the strength-in-service of the faculty and particularly the fact that only a few men have headed the department in more than 50 years: the late Vernon T. Stewart served as chairman from 1920 to 1946. An institutional reorganization in 1946 separated chemistry and chemical engineering administratively for 20 years. Under this arrangement Dr. M. Lelyn Branin headed chemistry and Dr. Charles L. Mantell was brought in from industry to readjust chemical engineering offerings to post-war professional needs.

Curriculum was revised, courses in plant design and chemical engineering kinetics were introduced; a master's program in chemical engineering was started in 1947 and AIChE accreditation for the undergraduate curriculum was received in 1950. Student interest in professional societies revived and the AIChE chapter was reinstated.

In recent years the department graduated an average of 100 ChE students per year, roughly 80 B.S., 18 M.S. and 2 D.Sc. students per year— a far cry from its first graduating class of three, more than half a century ago.



Joe Joffe, Chairman of Chemical Engineering and Chemistry.

In 1963 Dr. Mantell retired and Dr. Joseph Joffe was appointed chairman of chemical engineering; Professor George C. Keeffe, who had long been associate chairman, continued in that role. In 1966, upon the retirement of Dr. Branin as head of chemistry, the two areas were reunited as one department under Dr. Joffe. The continuity of department fidelity is perhaps best noted by the fact that Dr. Joffe will retire in 1975 with 43 years of service and Professor Keeffe in 1976 with 40 years of service.

Among the many factors that have contributed to the growth and productivity of Chemical Engineering/Chemistry at NJIT was the gift of a nearby industrial building in the 1950s which enabled the department to provide the facilities necessary for large undergraduate and graduate operations.

While some new buildings were added in the post-war years, NJIT's city location precluded any extensive expansion until the 1960s when urban renewal and several State college bond issues encouraged wholesale growth. NJIT's campus was able to expand from five buildings on two acres to more than a dozen on 20 acres, the most notable and latest of which is the new $7 million chemical engineering/chemistry complex.

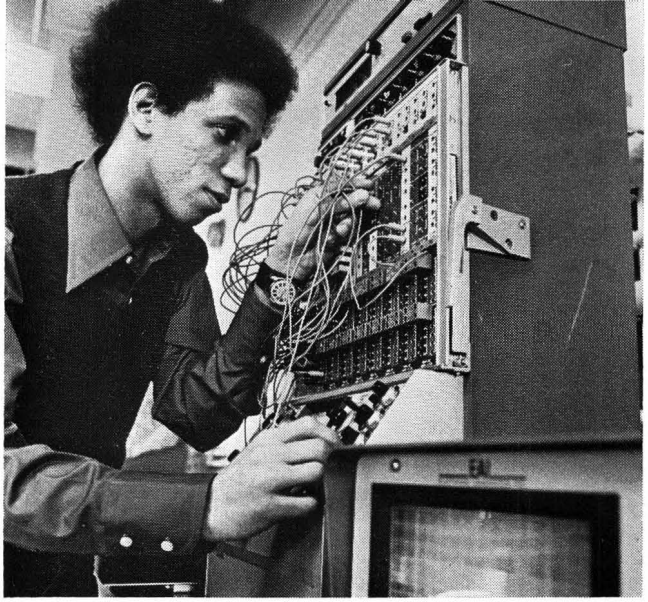
The physical growth in the 1960's was the prelude of discussion about broadening the educational offerings. Until the past decade only degree programs in engineering had been offered. In recent years a discernible interest in related professional career paths has led to viable programs in engineering science, computer science, and industrial management; undergraduate and graduate programs have established in these fields. Other degree programs have been added as well but the deciding factor in the change of name from Newark College of Engineering to New Jersey Institute of Technology was the creation of New Jersey's first public school of architecture as part of NCE in 1973. The new NJIT name became effective January 1, 1975.

Throughout its history the Departmental objectives of its undergraduate curriculum has been to provide a quality education which will enable graduates to either enter the chemical engineering profession directly or alternately, to enter graduate school well-rounded in theory and application. The objectives of the graduate programs have been to broaden and deepen the student's mastery of chemical engineering and related subjects so that he might participate to the fullest extent in the advancement and practice of the chemical engineering profession.

THE FACULTY

DUE TO THE PARTICULAR importance given to the chemical engineering/chemistry department at NJIT, the leadership and faculty support given to its educational effort is especially significant. As mentioned Dr. Joseph Joffe operates as overall chairman with Professor George Keeffe as associate chairman of chemical engineering and Dr. Howard Kimmel as associate chairman of chemistry.

It has been largely under this leadership—and during the past ten years—that the department has been able to achieve the national prominence it now has. This period also marked the most dynamic growth in terms of student enrollment, faculty growth and physical expansion. More than half of the present instructing staff of chemical engineering joined the faculty in the late 1960s as well as one-third of the chemistry faculty. In addition, Dr. L. Bryce Andersen, dean of academic affairs, and Dr. Wladimir Phillippoff, internationally-known rheologist, are members of the chemical engineering department. Most of the teaching staff are professional engineers and have extensive industrial experience.



Process Control simulation on EAI TR 20 Analog Computer.

CHEMICAL ENGINEERING STAFF

L. Bryce Andersen, Vice President of Academic Affairs.

Ernest N. Bart, Fluid Mechanics, Heat Transfer, Mini Computers and Applied Mechanics.

Hung T. Chen, Thermodynamics, Separation Theory (Parametric Pumping), Process Dynamics and Control.

Teddy Greenstein, Low Reynolds Number Hydrodynamics, Biochemical Engineering, Heat Transfer.

Deran Hanesian, Chemical Reaction Engineering, Fluidization, Process Dynamics and Control, Process Simulation and Optimization.

Ching-Rong Huang, Rheology, Biorheology, Biomedical Engineering, Polymerization Kinetics, Catalysis.

Joseph Joffe, Chairman of Department of Chemical Engineering and Chemistry, Thermodynamics (Equations of State, Vapor-Liquid Equilibria, Properties).

George C. Keeffe, Associate Chairman, Chemical Engineering, Mass Transfer, Solid Waste Recovery Processes, Photo-chemical Reactions.

Saul I. Kreps, Chemical Reaction Engineering, Catalysis and Catalytic Reactor Design.

John E. McCormick, Computer Applications to Engineering Problems, Applied Mathematics, Mass Transfer.

Wladimir Philippoff, Foundation Research Professor, Rheology.

Angelo Perna, Mass Transfer, Solid Waste Disposal, Air and Water Pollution.

Edward C. Roche, Jr., Process and Equipment Design, Process Simulation and Computer Applications.

Jerome J. Salamone, Assistant Chairman, Chemical Engineering, Non Newtonian Technology, Fluid Mechanics,

Heat Transfer.

Dimitrios Tassios, Applied Thermodynamics (Vapor-Liquid Equilibria), Air Pollution, Technology Assessment.

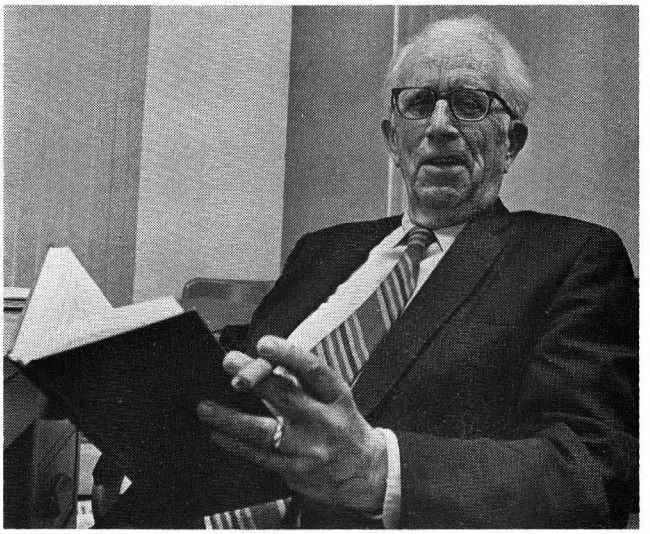
As one would expect from such a large staff the research interests encompass a broad spectrum. The chemistry faculty, in addition to the standard areas of research, (physical, analytical, inorganic and organic), are conducting research in the areas of water and air pollution, enzymatic removal of pollutants, polymers, biomedical and photochemical induced reactions. Funded research is currently being carried out in the areas of water pollution, blood rheology, hazardous waste disposal and process synthesis. Several NSF undergraduate equipment grants have helped to develop undergraduate laboratory experiments.

During the past year the members of the department have published 37 papers and presented 23 papers at national and international meetings. Additional activities of department faculty include consulting for the private and public sector as well as reviews for technical journals, and government agencies.

FACILITIES

IN 1969 GROUND WAS BROKEN for the Chemical Engineering/Chemistry complex, (Tiernan Hall) which was completed in 1972 at a cost of $7 million. The facility was designed as an office, educational and research complex, complete with the latest capabilities for audio-visual instruction. Its four-stories and basement contain a gross area of 140,500 square feet. The basement contains complete machine shop facilities, a modern rheology research lab, a subcritical nuclear reactor facility, equipment storage area and a student lounge. Instructional classrooms are on the first floor. With the exceptions of two large freshmen lecture halls, classrooms are designed to hold no more than 25 students. The second floor contains all the undergraduate chemistry laboratories. With the exception of department's minicomputer facilities, the third and fourth floors consist completely of research laboratories.

One of the distinctive features of the complex is the undergraduate laboratory facility which includes a four-story high-head area, housing the unit operations laboratory and a separate process dynamics control laboratory. The unit operations facilities consist of separate areas on each floor interconnected by a high-head area. The basement laboratory area, the largest in square footage, contains experiments related to heat, mass, and momentum transfer as well as several liquid-solid separation experiments. The first floor is basically a solids-fluids area where the drying and fluidized bed experiments are located. The second floor is used for housing experimental apparatus associated with the undergraduate research program and student project studies associated with the unit operations laboratory course. The third floor area contains a reaction kinetics laboratory. The experiments involve a 60 foot tubular reactor, backmix reactors in series, heterogeneous catalysis, surface properties of catalysts, non isothermal batch reactor, and a batch fermentation unit. The fourth floor contains process dynamics experiments in liquid level control, frequency response analysis and on-line reactor temperature controller tuning. Both EAI



George Keeffe, Associate Chairman of Chemical Engineering.

TR-20 and EAI TR-48 analog computers are available. Additional control simulation is provided if desired by an Autodynamics Process Control Trainer.

The laboratory experimental equipment units are essentially of pilot plant size and were recently purchased as part of the department's educational modernization philosophy.

A computation facility includes mini-computers, analog computers and teletypes for the on-campus UNIVAC 3 computer and a State-wide 370/158 IBM System. The analog capability consists of two fully equipped TR-20 machines, with DVM, oscilloscope and x-y plotter accessories and two TR-48 machines. Mini-computer equipment

includes a Wang console and five satellite keyboards, and two programmable 9000 series Hewlett-Packard systems. The 9100A H-P is complete with extended memory, printer and marked paper reader. The newer 9820A unit has two, read only, memory blocks one of which is a math package and the other is a user definable package. Since the unit has a compiler anyone familiar with modern computer programming can rapidly learn to program the unit. In addition, the 9820A is equipped with an alpha numeric printer allowing for convenient formating of printed statements. Programs for use with the H-P systems are designed and used by students for data reduction in conjunction with experiments in both the unit operations and process dynamics and control laboratories. This equipment is reserved for the use of the faculty and students of the department. The department takes great pride in the facilities and the resulting compliments expressed by visitors from both the industrial and academic sectors.

PROGRAMS

THE UNDERGRADUATE PROGRAM at NJIT has as its goal, an educational balance between technical and non-technical subjects so that the student graduating is not only technically competent, but reasonably sophisticated in social matters. Presently a total of 137 semester hours are required.

The mathematics and physics requirements satisfy ECPD standards and chemistry requirements meet AIChE standards. The chemistry contribution to the undergraduate ChE curriculum is significant in that the courses are designed specifically for the engineering student and are given to engineers by chemists who are colleagues. All the chemistry courses—freshman chemistry, organic chemistry, and physical chemistry—are oriented toward the basic educational needs of a chemical engineer.

Recognizing the need for greater exposure to modern analytical techniques, the chemistry faculty developed a sophomore analytical chemistry program which now will be required by all ChE students. The purpose is to give students the experimental experience in analytical techniques that will be needed in junior and senior laboratory courses.

In the humanities/social and organizational sciences, 27 credit hours are required, providing for non-technical subjects in every semester. There are five elective and four required courses in this sequence. This requirement is based upon a historic desire at the school to prepare its graduates for corporate management opportunities.

The standard chemical engineering subjects—calculations, process industries, thermodynamics, heat, mass, and momentum transfer, reaction kinetics, process dynamics and control, plant design, and chemical engineering laboratory—provide an additional 39 credit hours and another 9 hours of chemical engineering and technical electives are permitted. The program is more flexible than it seems because of a great deal of freedom in the "technical" and "ChE" electives. A student can use these three courses to develop a solid footing in chemistry, biochemistry, environmental sciences, nuclear chemistry/ physics, mathematics/computers, and others as well.

Although the courses on campus reflect the engineering aspects of the institution, a wider variety of liberal arts and life science programs can be considered in conjunction with a neighboring institution, Rutgers-Newark.

Internally, department programs are flexible and can be fitted into fields which include medicine, ecology, law, management, chemistry, process operations, research and design.

The focal points of the undergraduate curriculum are the senior Process and Plant Design course and the senior chemical engineering laboratories. In the Plant Design course the process and equipment design of process units is covered through three basic exercises focusing on process design, equipment design, and process-equipment parameter studies utilizing simulation models. The emphasis of the process design segment is to cover the flow and equipment sequence along with raw materials and location factors. Also the establishment of process operating conditions, material and energy balances, and the evaluation of necessary physical and thermodynamic data. The second segment concentrates on the preparation of preliminary investment and operating cost

The undergraduate lab facility includes a four-story, high-headed area for unit operations lab and a separate process dynamics lab. The former consists of separate areas on each floor interconnected by a high-headed area.

estimates, noting the size and/or mechanical designs of equipment, and the utility and instrumentation requirements. The third segment is an exposure to the interrelationships of process and design variables via the utilization of process simulation programs. The course is conducted through a group-oriented workshop atmosphere with written and oral summaries of accomplishments.

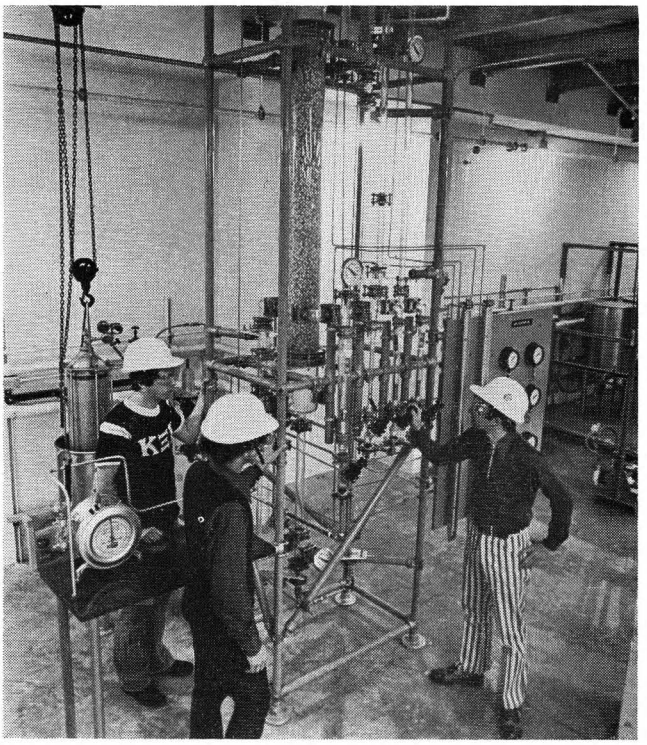
The selection of the specific examples for student solution requires some care in that the process must be non-propriety, basic process data must be readily available, and the scope such that a solution can be obtained within the duration of the course period. With these constraints problems have been formulated in conjunction with various industrial firms, and then used in the process and plant design course. The development of these design problems requires considerable effort, and thus NJIT has actively participated in the case study series as organized by Dr. Buford D. Smith at Washington University (St. Louis, Mo.).

In the undergraduate chemical engineering laboratory, the students are required to complete one experiment in each of the areas of heat, mass and momentum transfer and chemical reaction engineering. The remaining experiments in the two semester sequence are chosen by the students working in groups of three in accordance with their interest and desire for specialization.

The Process Dynamics and Control Laboratory is integrated with the course. Students spend nine weeks on theory and then seven weeks on pilot plant scale control experiments covering liquid level control, frequency response analysis, and on-line, chemical reactor temperature controller tuning for optimum control settings. Analog computations in control are also investigated by simulation of chemical reactions with concentration control by a proportional controller.

On the graduate level, standard master's and doctoral programs are available in chemical engineering. The degree of chemical engineer also available after 24 hours of course work and a minimum of twelve credits for a professional project. Although most of the candidates are part-time evening students, with the number ranging between 80 and 100, the department is concentrating on developing a larger full-time day program. At the present time, there are about 20 full-time master's and doctoral candidates.

The Chemistry Division offers a program leading to the Master of Science in Engineering Science. The requirements include a minimum of thirty credits which include the option of a six credit Master's Thesis or a three credit Master's Project. Nine course credits are prescribed in the areas of Inorganic, Physical and Organic Chemistry. The remaining credits are electives.



Unit Operations Lab Gas Absorption Experimental Apparatus.

STUDENT-DEPARTMENTAL ACTIVITIES

THE STUDENT POPULATION AT NJIT is basically a commuting one with the problems and attitudes associated with a metropolitan atmosphere. The majority of students hold down part-time jobs to help subsidize their educational and living expenses. Since NJIT is primarily engineering-oriented, there are many demands on a student's time. The department takes pride in its student organizations and in the recognition such societies have received. A close student-faculty relationship is characteristic of the department life. This close relationship has been nurtured primarily by the active student chapters of AIChE (established 1950) and Omega Chi Epsilon (established 1957 as Eta Chapter), and a recently formed Biochemical Club, and has been encouraged by an open door policy on the part of the faculty. □